UNSGM Designated Laboratories Workshop Report

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Executive summary

This report presents the outcomes of the ninth Swiss UNSGM Designated Laboratories Workshop organised by Spiez Laboratory on a network of trusted laboratories designated under the United Nations Secretary-General's Mechanism (UNSGM)[1] to investigate allegations of the use of chemical, biological and toxin weapons. The workshop series is a Swiss contribution to strengthen the operational readiness of the UNSGM. This effort is part of Switzerland's Arms Control and Disarmament Strategy 2022-2025[2]. It also links to the Secretary-General's Disarmament Agenda[3], with Action 10 addressing the readiness to investigate alleged use of biological weapons.

Today, the UNSGM is the only instrument available to the international community to investigate an alleged use of biological weapons. The UNSGM strongly depends on Member States' contributions in terms of nominating suitable experts and laboratories as well as providing support for the key components of the Mechanism. Together with activities organised by other Member States and coordinated with the United Nations Office for Disarmament Affairs (UNODA) – the custodian of the UNSGM – the Swiss workshop series aims at ensuring that the UNSGM is fit for purpose by promoting a capable, robust and trusted network of UNSGM designated laboratories.

The development of a trusted laboratory network is a gradual process of learning and implementation, enabled through practical exercises. Its constant evolution strongly depends on the sustained support of Member States and the active engagement of participating laboratories, in line with the UNSGM Guidelines and Procedures[4]. Significant contributions and commitments of the laboratories come with a wealth of benefits for the laboratories, such as opportunities for self-assessment and learning from others as well as exchange on analytical methods and standards.

The Swiss workshop series serves this dedicated laboratory community as an authoritative platform to further strengthen the UNSGM by providing transparency and confidence in scientific competencies, analytical skills as well as quality assurance systems.

This ninth UNSGM Designated Laboratories Workshop covered an impressive set of recent activities and developments, and highlighted the progress made on many subjects. This included numerous laboratory exercise formats, national approaches to microbial forensics, the analysis of toxins, guidance and documentation as well as a whole range of activities of relevance for the laboratory community. The workshop also emphasised the importance of laboratories in the context of a UNSGM mission, in particular the key issues of technical arrangements and laboratory reporting.

Previous workshops have demonstrated the critical role of laboratory reporting. Over several years, a working group has developed a draft template for UNSGM analytical laboratory reports that satisfies the standards of the UNSGM. The template is customisable to a specific context and provides flexibility for analytical laboratories. It also provides two reporting options of key data: a recommended reporting format to be readily filled out, or a possibility for the laboratory to use its own reporting format. Recently, it was submitted to UNODA as a contribution from Member States to the UNSGM. The reporting template is now ready for use and will remain a living document. This will ensure that relevant technological developments as well as further practical experience can be taken

[1] https://www.un.org/disarmament/wmd/secretary-general-mechanism
[2] https://www.eda.admin.ch/content/dam/eda/en/documents/aussenpolitik/strategien/strategie-ruestungskontrolle-und-abruestung-2022-2025-EN.pdf
[3] https://www.un.org/disarmament/sg-agenda/en
[4] Guidelines and Procedures for the timely and efficient investigation of reports for the possible use of chemical and bacteriological (biological) or toxin weapons. https://undocs.org/a/44/561

into account for continuous improvement of the template.

Recent discussions have touched on the issue of technical arrangements between laboratories and UNODA. This helped to identify the pressing need for added clarity for laboratories on the issues of technical arrangement and mandate, in order for them to better understand their role, their function and critical interfaces.

To this end, workshop participants were briefed on lessons from the work of the OPCW's Investigation and Identification Team (IIT) and previous UN/OPCW investigations. Such investigations have to deal with competing narratives. As a consequence, all hypotheses put forward need to be tested for plausibility, which requires a holistic assessment approach. Since these types of investigations may stretch over several years, having robust quality assurance systems in place at analytical laboratories is key for providing confidence in sample analysis results as well as demonstrating the integrity and quality of the entire process.

Since past OPCW and UN investigations have underlined the importance of preparations that need to be in place and the need for flexibility in responding to short-notice demands, workshop participants discussed the interaction between a designated laboratory and a UNSGM mission along the key phases of a typical mission timeline, based on practical experiences. A designated laboratory is likely to receive a short-notice pre-notification. If confirmed, a formal request for services will follow, which may also set out the legal context for the mission, the involvement of the laboratory, and delineate the expected types of laboratory services. Laboratories need to be aware that time between formal notification and arrival of the samples may be very short. As a consequence, preparations need to be in place that enable authorisations by relevant national authorities on extremely short-notice. A template for a technical arrangement between UNODA and the designated laboratory supporting a UNSGM mission may facilitate any necessary arrangements in advance. In terms of mandate, an example illustrated the level of detail that the tasking of the designated laboratory may entail. Finally, designated laboratories would benefit from guidance documentation that specifically assist them in understanding their role and function in an investigation and preparing to that effect.

Strengthening the microbial forensics capability and supporting the laboratory network of the UNSGM as well as other capabilities of the UNSGM are elements of the UK's Biological Security Strategy adopted in 2023. A further relevant element in this regard is the UK Microbial Forensics Consortium (UKMFC), which incorporates microbial forensics capabilities and a One-Health approach. The approach captures all biological hazards and aims at going beyond a simple identification of the biological hazard. To this end, a laboratory network for "frontline biosurveillance" has been established that is also keen to collaborate internationally with other laboratory networks.

Previous workshops have already looked at the particular challenges associated with the analysis of toxins, in particular the significant differences between high molecular weight (HMW) and low molecular weight (LMW) toxins which considerably impact the choice of analytical methods. Based on the Relationship Agreement between the OPCW and the UN, efforts are now geared towards a coordinated approach to avoid unnecessary duplications of activities and services. The OPCW also reported on the progress it has been making towards the establishment of a Proficiency Testing (PT) scheme for the analysis of toxins. After seven confidence building exercises, a first trial PT is now underway.

Since 2017, an increasing number of Member States have been organising laboratory exercises dedicated to the specifics of the UNSGM, in order for participating laboratories to gain pertinent experience and share best practices. This year, workshop participants were briefed on three laboratory exercise formats and their impressive achievements. Notably, participation and geographical representation in the various exercise formats have gradually increased over the

years. Sophisticated bioinformatics capabilities are available across the globe. Equally, skills in terms of agent identification to the strain- / toxin-level have reached very good performance levels. Even in scenarios dealing with suspect or even unknown target agents high performance levels by participating laboratories have been achieved. Nevertheless, challenges remain in the area of comprehensive agent characterisation, which is a key capability for forensic type investigations and for potential attribution purposes. Despite these challenges, the UNSGM has at its disposal a laboratory capacity that is proficient in biological agent analysis. Continuing these exercise formats will be central, since they provide an essential opportunity for the participating laboratories to assess their capabilities and further improve their performance.

Over the years, the Swiss workshop series has gradually broadened its scope to include the multiple interfaces and relevant connections between the laboratory analysis dimension and all other elements of an investigative process under the UNSGM. One important element in this regard is the comprehensive suite of guidance documentation that was developed by Canada and submitted as a national contribution to UNODA, basically benefitting the UNSGM with a tailored Quality Management Structure that is fit for purpose. Elements thereof were transposed by UNODA into Practice Notes, and in the case of sampling guidance have recently been used in specific UNSGM training formats. This also ties into the recent conduct of a 'biological crime scene management course', offered by INTERPOL in close cooperation with Canada and UNODA.

In a similar vein, several cross-cutting projects to strengthen the UNSGM, supported or implemented by the United States, were brought to the attention of workshop participants. This included a table-top exercise that was conducted jointly with Switzerland last June with the goal to better understand the potential implications of having concurrent investigations of a biological incident taking place at the same time. This demonstrated the complexities a UNSGM mission might be faced with and that more awareness and further efforts are needed to actively bridge both dimensions of One Health and law enforcement sectors.

In conclusion, substantial progress has been made thanks to the combined efforts of UNODA and Member States, including with the development of a network of designated laboratories. The network meets the highest scientific standards, and the growing number of participating laboratories from an increasing number of countries across the globe continue to improve their understanding of the political and procedural environment they would have to function in, should they be called upon to support a UNSGM investigation. In that regard, the continuous stream of laboratory exercises in various formats contributes to increasing laboratory proficiency and proves to be essential.

The workshop series has evolved into a planning platform for the development of this UNSGM laboratory network and serves as an interface between scientific expertise and policy processes. In terms of interfaces, it has now become evident that having a draft technical arrangement would be of immense benefit for the designated laboratories. UNODA will now proceed with formulating such a draft with the intent to then make it available to designated laboratories.

The Swiss workshop series organised by Spiez Laboratory remains an effective platform to discuss the issues of relevance to designated laboratories and help all partners coordinate their activities and share the results and progress. The tenth UNSGM Designated Laboratories Workshop is scheduled to take place from 9 to 11 September 2025.

1. Introduction

The ninth workshop on a network of designated laboratories of the United Nations Secretary-General's Mechanism (UNSGM), organised by Spiez Laboratory, was held from 11 to 13 September 2024. This workshop series is a Swiss contribution to strengthen the operational capacity of the UNSGM. This effort is part of Switzerland's arms control, disarmament and non-proliferation strategy[5]. Together with activities organised by other Member States and coordinated with the United Nations Office for Disarmament Affairs – the custodian of the UNSGM – the workshop aims to ensure that the UNSGM is fit for purpose.

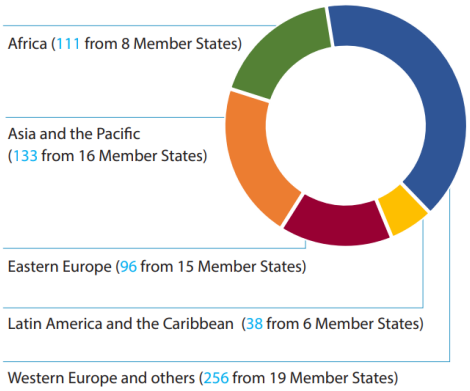
The workshop convened 68 participants from 15 Member States as well as the UN Office for Disarmament Affairs (UNODA), the Organisation for the Prohibition of Chemical Weapons (OPCW), the Biological Weapons Convention Implementation Support Unit (BWC ISU), the World Health Organization (WHO), the World Organisation for Animal Health (WOAH, prev. OIE), the International Criminal Police Organization (INTERPOL) and the Organization of American States (OAS). This report summarises the discussions and outcomes of the workshop.

The UNSGM was established by the UN General Assembly in 1987 and endorsed by the Security Council in 1988. As an impartial, science-based, international, investigative mechanism, the UNSGM gives the UN Secretary-General a tool to respond to reports from Member States about suspected uses of chemical, biological and toxin weapons. It is the only instrument available to the international community today to investigate an alleged biological weapons use.

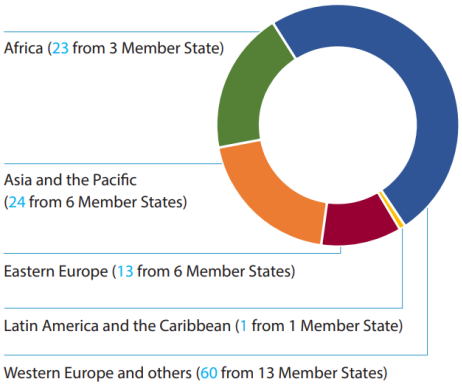
The UNSGM is not a standing investigative body, nor is it a capacity building mechanism. Its competence and readiness depend on the resources made available to it by Member States. Although not formally linked to the Biological and Toxin Weapons Convention (BTWC), efforts to strengthen the UNSGM also contribute to developing investigative capacities that the Convention could draw upon.

Building a network of designated laboratories complements other assets available to the UNSGM: qualified experts trained to conduct field investigations, expert consultants to render advice, and field exercises that test procedures and proficiency under realistic conditions. The following charts (Figure 1) provide an overview of the assets available to UNODA as of May 2024 (from UNODA's UNSGM Newsletter, Issue 8, June 2024):

634 QUALIFIED EXPERTS



121 EXPERT CONSULTANTS



[5] https://www.eda.admin.ch/content/dam/eda/en/documents/aussenpolitik/strategien/strategie-ruestungskontrolle-und-abruestung-2022-2025-EN.pdf

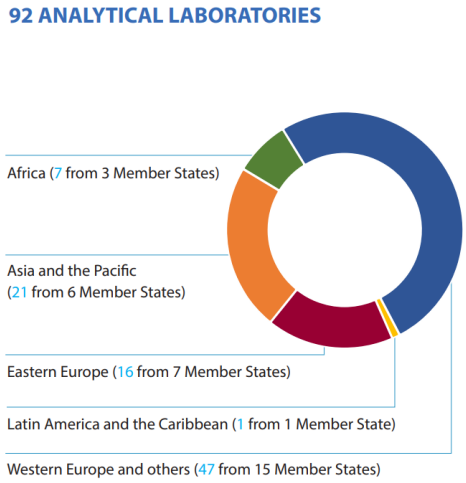


Figure 1: Status of the UNSGM roster – Nominations of qualified experts, expert consultants and analytical laboratories. Distributions along the five UN regional groups.

Training of qualified experts is important to ensure a timely, efficient, secure, and procedurally accurate conduct of UNSGM missions. The UNSGM training program conveys aspects like interviewing, evidence management including chain of custody, report writing, as well as safety and security.

Member States, UN entities and partner organisations offer training courses, including basic training as well as specialised courses to develop and refine particular skill sets, such as biological crime scene management, decontamination, investigative interviewing skills, as well as sampling and transportation of infectious material. The UN offers a course on Safe and Secure Approaches in Field Environments (SSAFE). Between June 2022 and November 2024, 14 basic and specialised training courses were conducted. Notably since 2022, the content of UNSGM basic training courses is standardised.

In order to test the acquired skills, Germany hosted the Capstone Exercise in Berlin in 2022. This included a table top exercise and a full-scale field exercise, which was organised by the Robert Koch Institute (RKI). The Capstone Exercise provided a valuable opportunity to determine the readiness of the mechanism and identify areas of further development.

Activities geared at a network of designated laboratories started in 2015.[6] Since 2017, an increasing number of Member States and organisations have been organising exercises dedicated to the specifics of the UNSGM[7], in order for participating laboratories to gain pertinent experience and share best practices. UNODA coordinates these interlaboratory calibration studies, e.g. external quality assurance exercises (EQAE), the results of which are assessed by expert consultants. A first workshop with expert consultants and focal points of UNSGM roster laboratories was held in May 2023. Discussions focused on criteria for the assessment of results of EQAE and on recommendations for EQAE providers. It also addressed approaches to UNSGM roster laboratories that did not participate in EQAE and to reassessing laboratories before being assigned to a mission.

For the coming two years, UNODA has identified several priorities:

- Clearing the training backlog and filling gaps in training content;
- Upgrading the roster database;
- Conducting regional workshops and awareness raising;
- Providing templates for laboratories;

[6] Previous workshops that discussed the setup and development of a UNSGM Designated Laboratory network were held in Stockholm (June 2015), Umeå (October 2016), Geneva (April 2016) and Spiez (November 2015, June 2016, June 2017, September 2018, September 2019, September 2021, September 2022 and September 2023). Complementing these discussions was a workshop on toxin analysis (Berlin 2020). In 2023, the Temporary Working Group on biotoxins analysis of the OPCW Scientific Advisory Board published its report, identifying "priority toxins" for which analytical capacities are most needed.

[7] Germany runs the project RefBio with annual wet-lab exercises on the analysis of viruses, bacteria and toxins. Activities are supplemented with regular trainings and workshops. The project started in 2017 and is currently funded until the end of 2024 (end of second project phase).
Dry-lab exercises in genomic sequence analysis of bacteria were organised by Denmark and Sweden with US funding in 2018/19. Germany, Denmark and Sweden, financially supported by the US, have been conducting dry-lab exercises for virus identification and characterisation since 2021.
China conducted a wet-lab exercise on the identification of a 'disease X' in 2022, and another wet-lab exercise in 2024 ('future pandemic testing').
The OPCW has conducted seven toxin analysis exercises (2016-2023), followed by a first trial Proficiency Test of toxin analysis in 2024. Biotoxin exercises were also conducted under the EU funded projects EQuATox (2012-2014) and EuroBioTox (2017-2023).

- Developing draft agreements between roster laboratories and the UN;
- Further increasing the readiness of the UNSGM;
- Implementing the recommendations from the pre-deployment orientation workshop.

Past UNSGM Designated Laboratories workshops have clarified many requirements for laboratories selected to support a UNSGM investigation:

- There are three levels of a microbial forensic investigation: 1) unambiguous agent identification, 2) agent characterisation to differentiate natural outbreaks from man-made events, and 3) attribution, i.e. examination of evidence towards identifying possible sources and/or perpetrators of an agent release.

- Many laboratories can conduct the types of analyses required in a UNSGM investigation, but agents and sample types may differ from what they normally investigate.

- Laboratories must have a strong quality system in place, meet the highest biosafety and forensic standards, and comply with procedural requirements that include an unbroken chain of custody.

- Unambiguous agent identification typically requires the use of several orthogonal analytical techniques. There is a need for validated methods, recommended operating procedures, agreed acceptance criteria, curated reference standards and databases, and open-source software.

- Interaction between field investigators and the analytical laboratories is desirable. Laboratory expertise should be embedded in field teams, and possible support structures (e.g. a designated laboratory operating as a 'secure work area', or a mobile laboratory) have been proposed. Guidance has been developed for sample collection, packaging and shipment.

- Reporting of analytical results must withstand both technical and political / legal scrutiny, demonstrate an unbroken chain of custody, show the quality assurance and validation processes applied, and describe the findings as specifically as capabilities allow.

The development of a trusted laboratory network is a step-by-step process of learning through practical exercises. Coordinated by UNODA, it is driven by the participating laboratories that should be geographically representative.

EQAE demonstrate the proficiency of UNSGM roster laboratories and serve UNODA in assessing the capabilities of these laboratories by means of expert consultants. Any future Head of Mission can use this information when selecting analytical laboratories to support a mission.

Participating in activities of the network benefits the laboratories in several ways: it provides opportunities for self-assessment and learning from others, and provides access to analytical methods and standards. This ninth workshop was another milestone in the evolution of this UNSGM Designated Laboratory network.

2. Laboratories in the Context of a UNSGM Mission

2.1 Laboratory Reporting Template

Previous UNSGM Designated Laboratories workshops have highlighted the critical role of laboratory reporting to a UNSGM mission team. Experts from the German RefBio project and the United States have developed a reporting template that laboratories can use to report their activities and results in ways that satisfy the standards of the UNSGM. A first draft was reviewed at last year's workshop and subsequently revised, based on comments received during and after the meeting. The revised template was then tested in an EQAE and, after further refinement, submitted to UNODA as a voluntary contribution for the UNSGM. It will, however, remain a living document, i.e. future amendments and refinements will be reflected, based on technological developments and insights gained from practical experience.

The reporting template is currently designed as a single reporting format for all agent types – bacteria, viruses, fungi, possibly other living organisms, and toxins. A first section of the template serves to identify the laboratory and delineate the analytical approaches employed as well as the quality management system used, including details on the chain of custody, such as sample check-in at the laboratory.

This is followed by the analytical plan and a summary of analytical results. The analytical plan sets out the Head of Mission's tasking of the laboratory, identifies the samples received by the laboratory and their priority with regard to agent identification as well as characterisation. The analytical summary contains the laboratory's final statement on agent identification and characterisation. It also includes the analytical investigation and any observed peculiarities – i.e. any distinct special features.

The template then allows for two reporting options of key data of the analyses conducted: a recommended reporting format to be readily filled out, or a possibility for the laboratory to use its own reporting format. In future RefBio EQAE, participating laboratories will have to use the recommended reporting format. This contains a set of tables that allow laboratories to report on relevant findings: agents identified (including key data on isolation, enrichment and infectivity), phenotypic drug resistance profiles and antimicrobial susceptibility testing, agent characterisation (including identification of virulence and resistance genes, serology screening in clinical samples and functional activity tests of biotoxins).

The reporting template is customisable to a specific context: Tables can be duplicated, extended or deleted as required, depending on the tasking and the actual analyses conducted. Raw data considered to be relevant to the assessment of results can be attached as appendices. This may include chromatograms or spectra, microscopic photographs, plate readouts, sequences, phylogenetic trees, and antibiograms.

Accreditation certificates associated with the examinations conducted, laboratory procedures used, and validation data defining assay performance (including for previously non-validated methods) are not part of the report, but are to be made available on demand should that need arise. The same applies to raw data not already submitted as an appendix to the report.

An agreement on the analytical plan between the Head of Mission and the laboratory selected for off-site analysis is the basis for reporting of laboratory results. The laboratory reporting template, as it stands now, provides flexibility for analytical laboratories, while at the same time ensuring that all key data required by a Head of Mission are part of the report as well as protecting anonymity and confidentiality. In this sense, the template is ready for use now and will remain a living document.

2.2 Laboratories in the Context of a UNSGM Mission – the Wider Picture

Discussions at previous UNSGM Designated Laboratories workshops have focused on the analytical work of designated laboratories, issues related to the interface with the field investigation team and the reporting to the Head of Mission. More recently, discussions have touched on the issue of technical arrangements between laboratories and UNODA. These discussions not only highlighted the importance of technical arrangements, but also showcased the need for added clarity for laboratories on this issue as well as the mandate, in order for them to better understand their role, their function and critical interfaces. In other words, laboratories need a better sense of what to expect and how to be best prepared, should a laboratory ever be asked to provide its services in a UNSGM mission context. To this end, workshop participants were briefed on lessons from the work of the OPCW's Investigation and Identification Team (IIT) and previous UN/OPCW investigations.

2.2.1 The Wider Picture – Assessing the Credibility of Competing Narratives

The establishment of the IIT was the latest in a series of steps to investigate chemical weapons uses in Syria. After the accession of the Syrian Arab Republic to the Chemical Weapons Convention (CWC) in 2013, the Declaration Assessment Team (DAT) and the Fact-Finding Mission (FFM) were established in 2014. The DAT was established to engage on gaps, discrepancies and inconsistencies in the Syrian initial declaration and mandated to verify accuracy and completeness of the declaration. The FFM was mandated to investigate reports of chemical weapons use in Syria, however without making attributions of responsibility. Both *ad hoc* investigative mechanisms are still ongoing. In 2015, a first mechanism to gather information that would allow attributing responsibility for confirmed CW uses in Syria was established by the UN Security Council – the OPCW-UN Joint Investigative Mechanism (JIM). Its mandate was, however, not extended in 2017. In 2018, the OPCW adopted decision C-SS-4/DEC.3 on "Addressing the Threat from Chemical Weapons Use" which established the IIT. Its mandate is to identify the perpetrators of the use of chemical weapons in Syria by reporting on all information potentially relevant to the origin of those chemical weapons. The IIT also preserves the evidence and provides it to the International Independent Impartial Mechanism (IIIM)[8] and other relevant investigatory bodies established under UN auspices.

The IIT is a fact-finding mechanism, not a prosecutorial or judicial body. It does not make any attributions of criminal responsibility, nor does it make any recommendations for future action or determinations of non-compliance with the CWC. Such decisions are the prerogative of the OPCW's policy-making organs. The IIT uses a standard of proof of "reasonable grounds to believe", consistent with the practices adopted by the UN and other international fact-finding bodies, commissions of inquiry and similar entities.

IIT investigations have to deal with competing narratives – different scenarios put forward by different actors. An investigation plan of the IIT would start with outlining a preliminary working hypothesis about how the incident might have occurred, who the alleged perpetrators might have been, how these perpetrators may have acquired the substances used, and how they were employed. In addition, the IIT attempts to identify which actor(s) within the given context would have had motivation, history, means, expertise and capability to manufacture and employ a chemical weapon.

Based on this initial analysis, the IIT then investigates concrete scenarios on the basis of all information available at that stage. This information starts with the evidence collected by the FFM and its findings, which may include reports, witness statements, data from sample analyses, remnants and measure-

[8] The IIIM was established by the UN General Assembly in 2016 to assist in the investigation and prosecution of persons responsible for the most serious crimes under International Law committed in the Syrian Arab Republic since March 2011.

ments / images of munitions accessed or obtained. The IIT also evaluates information provided by States Parties in official statements, diplomatic notes, other communications and reports on chemical analysis. Equally, the IIT also analyses papers and analytical products from other sources, reports from non-governmental organisations and UN entities, and open-source information. This consistently includes allegations of "staged incidents", "false-flag" chemical attacks and "fabrication" of evidence.

An IIT case investigation focuses on six areas of inquiry:

- Context of military activities in the area;
- Chemical analyses;
- Symptoms of affected persons;
- Accounts and assessments of munitions used and their impact;
- Assessment of delivery system and trajectories;
- Possible origin of remnants found at the site(s).

To this end, the IIT examines all investigative hypotheses, and maintains a critical approach towards each posited scenario until the very end of its investigation. It remains open to other hypotheses that could explain an incident and attempts to expand its evidential basis by encouraging States Parties and other entities to share additional information on the incident and its perpetrators. It performs supplementary analysis of the evidence base gathered by the FFM, and consults leading experts who work independently on each area of inquiry. All information and evidence are holistically assessed. No finding is based on a single piece of evidence. Conclusions are based on combinations of different pieces of evidence, consistency between evidence and scenario, and corroboration of analytical data, expert assessments, witness statements, official documents, photographs and video footage, forensic analysis, open-source data, gas dispersion modelling and trajectory simulation. It is the combination of these various investigative methods that provides confidence in the IIT's findings. The IIT pursues its investigation to the point where it is left with only one plausible explanation for the concurrence of all the information before it, which it presents in its case report.

Assessing the credibility of competing hypotheses is challenged by a growing amount of disinformation around CW incidents in Syria. "Alternative hypotheses" are proliferating, and each of them must be tested. This requires ever more robust investigative methodology, time and resources. At the same time, this also creates opportunities to broaden the evidential basis. What matters for the credibility of the IIT's findings is its ability to demonstrate the integrity and quality of the entire process.

In this methodology, OPCW designated laboratories play an important role: they have been asked to perform additional analyses of FFM samples using more sophisticated instrumentation or a different analytical scope, or to analyse samples collected by the FFM that had not previously been analysed. They have been asked to perform data mining when a target compound had been found in quantities below the reporting threshold in FFM samples. These interactions between the IIT and the OPCW designated laboratories benefited from support by the OPCW Laboratory and the diplomatic framework of the OPCW.

2.2.2 The Wider Picture – Providing Clarity for the Laboratories

The experience of laboratory engagement in different OPCW and UN investigations has underlined the importance of preparations that need to be in place and the need for flexibility in responding to short-notice demands. To illustrate the requirements that a designated laboratory would have to meet when supporting a UNSGM mission, key phases of the interaction between a designated laboratory and a UNSGM mission were presented along a typical mission timeline, based on practical experiences.

<u>Before the arrival of samples at the designated laboratory</u>

The designated laboratories to support a specific mission will be selected by the Head of

Mission, likely supported by UNODA and UNSGM expert consultants. First, the designated laboratories are likely to receive an informal request to seek confirmation that they will be able to support the mission – this is likely to be a short-notice pre-notification. If confirmed, the designated laboratories will receive a formal request for services.

In an example from a previous mission, the formal request set out the legal context for the UNSGM mission and the involvement of the designated laboratory. The request also delineated the different types of services the designated laboratory was expected to provide. This included information and requirements concerning the transport of the samples, procedures and guidelines for sample handling and analysis, the mission staff assigned to interact with the designated laboratory, the reporting requirements and any additional activities expected. It also addressed provisions on costs and on the protection of confidentiality. In addition, there were general requirements dealing with liability, force majeure, privileges and immunities, the settlement of disputes, and on amendments and termination of the arrangement. This request was sent to the Head of the laboratory, with copies sent to the CWC National Authority of the country as well as its Permanent Representative to the OPCW.

At this stage in a UNSGM mission, time is critical. In the example, the time between formal notification and arrival of the samples at the Point of Entry (PoE) was two days (Saturday to Monday). To meet this tight timeline, a number of preparations needed to be in place, or had to be authorised on extremely short-notice. Preparations will have to address several issues, including:

- Will the samples arrive with an escort and who will be that escort (team members of the mission, national escorts of the originating country);
- Has a draft technical arrangement between the laboratory and UNODA been prepared;
- Which mission-specific agreements need to be concluded and who has authority to sign them;
- What arrangements are needed to take the samples through the country's PoE and clear them through customs;
- How will the samples be transported from the PoE to the designated laboratory (police escort, special transportation requirements);
- Which other national entities / actors will the designated laboratory have to consult to ensure the smooth transfer of the samples from the PoE to the designated laboratory?

While some of these preparations will be mission-specific, others, such as the identification of the authority to take certain decisions, can be clarified well in advance. This example illustrated how important it is to have a template for a technical agreement / arrangement between UNODA and the designated laboratory supporting a UNSGM mission available. This enables UNSGM roster laboratories to prepare for a possible mission and work with the relevant national authorities to make any necessary arrangements in advance, to ensure that the sample transfer and reception will be carried out smoothly and in a timely manner.

<u>Upon arrival of the samples at the designated laboratory</u>

Upon reception of samples at the designated laboratory, the sample packaging containers will be opened and the accompanying documentation checked (number and type of samples, seal status and number / signature, sample amount and quality). From there on, the designated laboratory assumes responsibility for the protection and preservation of the samples, and ensures an unbroken chain of custody. The designated laboratory needs a dedicated space for sample reception and secure storage. It will also receive the mandate with the scope of analysis and instructions that may address safety, prioritisation of samples / analyses or any other instruction of relevance for the designated laboratory. The escort may wish to be present at this stage and may have additional information to pass on to the designated laboratory.

An example for a mandate was presented to illustrate the level of detail that the tasking of

the designated laboratory may entail. In the example, the initial task was to test samples for a particular nerve agent and its primary and / or secondary hydrolysis products. If none of these were identified, additional tasks with increasingly broader scope followed: Chemicals from the same or other relevant groups of chemicals in Schedule 1; Organophosphorus pesticides and / or their primary and / or secondary hydrolysis products; Other chemicals with anticholinesterase activity and their metabolites. Finally, if time permits, chemical signatures that may be relevant to identify the synthesis pathway used to make the agent or components of tactical mixtures such as stabilisers should be reported.

A clear understanding of the tasking is essential, as this will determine how the designated laboratory will report its results to the Head of Mission.

Analysis of the samples at the designated laboratory

The designated laboratory will have to implement measures to control access to the samples and related information. It will also have to implement a system of accounting for all sample material. A particular challenge may be that observers may wish to witness the work. That may be complicated depending on laboratory regulations, layout, size and other parameters.

Basis for the analytical work will be an agreed analytical plan. Based on the mandate, the plan indicates the experiments to be conducted, all depending on the designated laboratory's sample preparation, screening and analytical methods, instrumentation, quality assurance system, and standard operation procedures. Again, time management will be of the essence.

Documentation and communications between the designated laboratory and the investigating mission

The designated laboratory needs clarity about how and with whom to communicate, and which communications protocols to follow, including security and confidentiality issues. The designated laboratory and the mission also need to agree on how the laboratory report will be submitted, taking due account of operational security and confidentiality as well as other relevant administrative arrangements. Clarity is also needed about data storage requirements: what types of data must be collected, what types of data must be submitted to the mission, by when and by what means.

There may be a request to submit an interim report on certain aspects of the mandate, given the urgency of the matter or certain deadlines within the investigative process. The final report should be submitted using a template, and by a deadline given in the mandate.

Procedures and requirements to be observed by the designated laboratory after the investigative mission

Agreements will be needed with regard to any unused sample material: what should be destroyed, what should be returned to the mission team, what needs to be stored by the designated laboratory for how long and under which conditions. The same will apply to data: which raw data must be stored by the designated laboratory and for how long, how must these data be stored (rules for data access and confidentiality), and how must data be deleted. Any requirements for future access to the sample material and data by UNODA or other UN bodies will need to be agreed. The same applies to decision making after the mission team has been disbanded.

The sense of the workshop was that UNSGM roster laboratories would benefit from certain guidance documentation that would specifically assist them in understanding their role and function in an investigation and preparing to that effect.

3. National One-Health Approaches to Microbial Forensics (United Kingdom)

The Defence Science and Technology Laboratory (DSTL) of the UK presented a new project: the UK Microbial Forensics Consortium (UKMFC), which incorporates microbial forensics capabilities and a One-Health approach. Strengthening the microbial forensics capability and supporting the laboratory network of the UNSGM as well as other capabilities of the UNSGM are elements of the UK's Biological Security Strategy adopted in 2023. The UK's approach towards microbial forensics is based on a broad understanding that captures all biological hazards (bacteria, viruses, toxins, and also pests) and aims at going beyond a simple identification of the biological hazard. The approach specifically looks for data related to origin / provenance, indicators for growth in a laboratory environment, and any signatures of genetic engineering. Unlike the UK's current capability that is focused on human health threats, the newly developed UKMFC integrates a One-Health approach. It brings together frontline biosurveillance laboratories working in human, animal, plant and aquaculture health, food security, forestry and other areas. Its aim is to build a critical mass of microbial forensics expertise.

First, interviewing around 200 individuals from some 60 organisations in the UK served to map the UK biosurveillance capabilities and identified opportunities to develop a microbial forensics capacity. Particularly genomics was identified as a core capability for biosurveillance activities. Subsequently, a bioinformatics working group was established in February 2024, initially involving 42 individuals from 13 different UK organisations, which began developing shared cross-sector working practices.

The project also established a laboratory network and developed shared working practices for use in the "Alert" phase: when a biological event occurs, the responsible sector raises a sectoral alert and conducts an initial identification of the incident cause as well as attempts to detect any "anomalies". A broader microbial forensics approach will be applied to answer a series of questions, including whether the event was natural, accidental or deliberate. At this stage, the UKMFC will be activated.

A first *in silico* EQAE to establish a baseline of existing capabilities and to test the efficacy of the new working practices is planned for late 2024. A next phase of the project will also engage with academia, small to medium sized enterprises, and industry at large.

The UK approach is complemented by a wider UK-US strategic partnership in microbial forensics and attribution, led by the UK Cabinet Office and the White House. UKFMC is also keen to collaborate internationally with other laboratory networks.

The creation of UKMFC is seen as a world-leading One-Health approach, setting a benchmark for UK preparedness with regard to animal, plant and aquaculture health. The laboratory network for "frontline biosurveillance" and an advisory board are the first tangible outcomes. Suitably qualified expert personnel have been identified across government and different sectors, and they have an agreed set of working practices at their disposal. The UK is now capable of dealing with surge events irrespective of the originating sector. The capacity to detect and attribute nefarious biological events early on by UKMFC can save millions, even billions of pounds, protect the UK and her assets, and serves as a deterrent against the use of biological agents.

4. Analysis of Toxins

Previous UNSGM Designated Laboratories workshops have already looked at the particular challenges that toxin analysis poses for a UNSGM investigation. Relevant concentrations of toxins are much lower than in the analysis of other chemical agents and there are significant differences between high molecular weight (HMW) and low molecular weight (LMW) toxins which considerably affect the analytical methods to be used.

4.1 Towards a Harmonised Approach for Toxin Analysis and Reporting

A particular challenge emanates from the fact that the CWC, the BTWC and the UNSGM all apply to toxins. Whilst the BTWC lacks an investigating mechanism, both the OPCW and the UNSGM have mandates to investigate the use of toxins as weapons, which calls for a close relationship between the two. The basis for this is the Relationship Agreement between the OPCW and the United Nations of September 2000. Amongst others, it authorises the OPCW to cooperate closely with the UN Secretary-General in investigations of the alleged use of chemical weapons which involves a State Not Party to the CWC or in a territory not controlled by a State Party. In addition, the efforts by the OPCW and the UNSGM to develop capacity to investigate incidents involving toxins require a coordinated approach to avoid unnecessary duplications of activities and services. Furthermore, both draw on the same scientific and institutional basis in countries that nominate laboratories to the UNSGM as well as for designation by the OPCW.

The OPCW has begun developing a concept for enhancing its capacity for the analysis of toxins, based on recommendations by its Scientific Advisory Board (SAB). Nine most relevant toxins have been identified by the SAB, including both HMW and LMW toxins. With regard to HMW toxins, the SAB recommended that the OPCW should develop minimum specification requirements for performance criteria of immunological and activity assays and that it should do so in close partnership with the UNSGM. The SAB further recommended that the OPCW should work closely with the UN and other interested organisations and laboratories, in order to:

- Establish an informal network for forensic toxin analysis;
- Develop common guidelines and best practices;
- Coordinate the requirements for quality assurance and related performance and acceptance criteria for toxin analysis;
- Develop a reporting format that would meet the requirements of both the OPCW and the UNSGM; and
- Coordinate efforts to minimise gaps and avoid unnecessary duplications.

The OPCW has now embarked on a three-year project, funded by the Global Partnership and the UK Ministry of Defence, to develop analytical techniques, methods and a validated test kit for ricin. The Technical Secretariat has also contacted UNSGM roster laboratories to strengthen the relationship between the OPCW and the UNSGM, addressing existing capabilities with regard to both HMW and LMW toxin analysis. The OPCW has also provided feedback on the proposed draft UNSGM reporting format template, providing lessons-learned from OPCW Proficiency Tests. In early 2025, the OPCW plans to host a workshop to better understand global analysis capabilities for non-scheduled toxins of interest, as identified by the SAB.

4.2 First Trial OPCW Biotoxin Proficiency Test (Saxitoxin)

The OPCW reported on the progress it has been making towards the establishment of a Proficiency Testing (PT) scheme for the analysis of toxins. After seven confidence building exercises, a first trial PT is now underway. Initial discussions with the laboratory that has prepared the samples started in October 2023 and PT samples were finally dispatched in August 2024. The evaluation of the laboratory reports is scheduled for September / October 2024 and a meeting to discuss preliminary results is planned for January 2025.

Moving from the previous confidence building exercises to a first trial PT involved several changes in terms of documents, scoring system and reporting timelines. The trial PT was scenario-based, involving an attempted poisoning event. One liquid sample from a kitchen as well as an aqueous sample from a nearby biotechnology facility had been collected for analysis but the State Party concerned lacked capability to perform the analysis. The samples were sent to the OPCW where the typical positive and negative control samples were prepared. Participating laboratories were tasked to analyse the samples for the presence of saxitoxin, analogues of saxitoxin and related chemicals.

28 laboratories from 21 States Parties took part in the trial PT, which is a slight increase from the previous confidence building exercises. Laboratory participation according to regional groups was as follows: 36% Western European and other States, 29% Asia-Pacific States, 7% Eastern European States, 4% African States and 4% Latin American and Caribbean States.

For 2025, the OPCW will continue to work on harmonising the scoring system for HMW toxins and on a new set of guidelines for HMW toxins. A second trial PT is also being prepared with ricin as target agent. In 2026, discussions with States Parties and the OPCW Executive Council are planned, to prepare the ground for moving towards Official OPCW Biotoxin Proficiency Tests and formal designation of laboratories for toxin analysis.

5. Laboratory Exercises

5.1 RefBio External Quality Assurance Exercises (Germany)

The RefBio project to strengthen the diagnostic capabilities of UNSGM roster laboratories began in 2017 and is funded by the German Foreign Office. Phase 1 of the project lasted from 2017 to 2021 (extended due to the pandemic), the current phase 2 runs from 2022 to 2024. The project provides annual EQAE in the three areas of viruses, bacteria and toxins, combined with specialised workshops and laboratory training for participating laboratories.

As detailed in the following graph (Figure 2), the project has attracted an increasing number of participating laboratories from a growing number of countries:

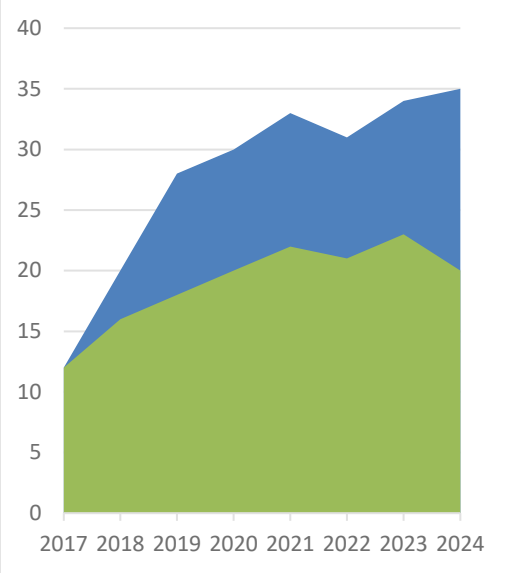


Figure 2: Participating laboratories and countries in project RefBio – Over the course of the project RefBio, the number of participating laboratories (blue) from participating countries (green) has increased.

Participation and geographical representation have gradually increased, but in recent years important challenges have emerged, in particular due to a sharp increase of sample shipment costs and more rigorous import regulations.

EQAE on bacteria

The RefBio bacterial exercise 2023-2024 involved the identification and characterisation of *Bacillus anthracis*. 29 laboratories from 19 countries took part, amongst them 21 roster laboratories. The scenario was built around the uncovering of a clandestine laboratory that was in the process of preparing a deliberate agent release. The participating laboratories were tasked to identify positive and negative samples as well as analyse the plasmid content. Furthermore, the laboratories were asked to characterise the agent, i.e. bacterial strain, molecular profiling, antibiotic resistance, and presence of virulence genes.

Most laboratories correctly identified *B. anthracis*. Only one false-positive result and one false-negative result were reported. The plasmid content was correctly identified by the majority of laboratories (86-100%).

The results of the characterisation tasks were more variable. Only three laboratories conducted all tasks for the infectious samples. In the case of the non-infectious samples this number rose to six laboratories. The results of molecular profiling varied between laboratories and, depending on the method used, showed that Multi Locus Sequence Typing and canonical Single Nucleotide Polymorphism analysis were more successful than Multi Locus Variable Number of Tandem Repeats typing. The correct identification of the bacterial strain turned out to be the biggest challenge with a 20–31% success rate. With regard to the screening for antibiotic resistance and the presence of virulence genes, the interpretation of the screening results was identified as a major challenge.

Of the 29 laboratories, 20 used broth and agar plates culture (10 methods were accredited), 29 used amplification-based methods (15 were accredited), and 25 used Next-Generation Sequencing (9 were accredited). Almost all laboratories conducted high-quality sample documentation and were able to demonstrate chain of custody for samples and data.

In summary, the UNSGM has at its disposal a laboratory capacity that is proficient in bacteriological analysis. More efforts are, however, needed to improve the interpretation

of results from Next Generation Sequencing, the application of microbial profiling, and ensuring the chain of custody. Frequent exercises are important to maintain and steadily increase proficiency of laboratories. Efforts will have to address the current challenges with strain identification and in-depth characterisation, sample matrices inhibiting downstream workflows (e.g. milk, blood), low target concentrations, and limited availability of sequencing data in public databases.

The next exercise will start in October 2024, involving the identification and characterisation of *Yersinia pestis*. Training on identification and characterisation of *B. anthracis* will be conducted online in November 2024. It will provide an overview on microbial and molecular tools and introduce participants to taxonomic profiling and workflows of computational analysis.

EQAE on viruses

Past viral EQAE involved the identification and characterisation of orthopoxviruses (2018 and 2019), SARS-CoV-2 (2020), haemorrhagic fever viruses (2021) and encephalitis viruses (2022). The general tasks of these exercises included species identification, characterisation by strain and mutations of the genome, and identification of irregularities (contamination, recombination, artificial fragments). The challenges so far included low virus concentration, genome rearrangements and inhibiting background.

For the 2023-2024 exercise, Mpox virus was selected as a target agent. This virus is an orthopoxvirus, a family of viruses which have already been a target of the exercises in 2018 and 2019. 25 laboratories from 14 countries participated in this exercise and were tasked with the identification and characterisation of Mpox virus, clade and lineage identification, and the detection of irregularities. The main challenge was the identification and characterisation of genome modifications (natural and artificial).

All positive and negative samples were identified correctly, there were no false-positives or false-negatives reported. With regard to clade identification, 22 laboratories identified all clades correctly. Lineage identification turned out to be more challenging: the 20 laboratories using Next Generation Sequencing technology reported 69% correct results, two laboratories using PCR reported 8% correct results, and one laboratory using other methodologies reported 17% correct results. The overall level of correct reporting was 57%.

With regard to the detection of irregularities, genomic rearrangements in two samples were identified and described by 8% and 28% of the reporting laboratories, respectively. A small deletion in another sample was identified and described by 16% of the participants, whereas a GFP vector in yet another sample was identified by 24% of the reporting laboratories.

Looking at all virus EQAE since 2018, the participation has grown with a peak in 2020 during the COVID pandemic, likely due to the selection of coronaviruses as target agent. Proficiency in species identification is high, however proficiency in strain and variant identification and the identification of mutations remains low. It is important to boost the proficiency in genome characterisation and the ability to detect and interpret signs of genetic engineering, which is key for forensic investigations and attributions.

The next virus EQAE starts in October 2024 and will use inactivated filoviruses as a target. Tasks will again include identification of the virus and a characterisation of the genome, which will be followed by a training on filovirus genome characterisation.

EQAE on toxins

Between 2019 and 2023, four toxin EQAE have been conducted. Between 13 and 16 laboratories participated in these exercises. The number of samples per exercise ranged between 9 and 18, containing potentially active toxins with bioterrorism relevance at concentrations between 10 and 3000 ng/ml. The matrices included simulated clinical samples (e.g., human plasma), environmental samples (e.g., swabs), and food (e.g., milk). The participating laboratories were typically

tasked with identification and characterisation of the samples, with a particular focus on activity, quantity, subtype / isoform, and questions related to source attribution, matrix composition and purity.

As in 2019, the 2023 EQAE had ricin as a target agent. However, this time the exercise was significantly more challenging than four years ago. In addition to ricin isolectins D and E, the scope was expanded to abrin as well as closely related agglutinins. Furthermore, concentration ranges were significantly lowered by roughly tenfold, i.e. 10-500 ng/ml, and more challenging matrices were used.

14 laboratories participated in the exercise and used a whole range of methods that included immunological methods, mass spectrometry, and functional assays. Of note, the differentiation of the isolectins was only possible by mass spectrometry. Only some laboratories addressed the questions related to agglutinin and isolectins.

The success rate of the 14 participating laboratories in terms of identification was 90% for ricin samples, 71% for abrin positive samples, and 98% for negative samples. Notably, only few laboratories performed isotyping, i.e. differentiation of ricin D and E, which is of importance for forensic purposes. Performance levels in terms of quantification were 81% for ricin with 13 participating laboratories, whereas for abrin 56% were achieved with 10 participating laboratories. In addition, activity testing was conducted by 8 laboratories for ricin with a success rate of 91%, whereas 6 laboratories achieved 71% for abrin.

One important conclusion from the exercise were the observed differences in laboratory performance and scope of methods applied that highlighted the need for a more systematic sharing of best practices and methodologies. It was also recognised that only highly proficient laboratories are able to reliably differentiate between the different toxin variants, conduct precise quantification, detect closely related substances, and provide information about the matrices.

The next EQAE in 2024 will use Staphylococcus enterotoxin B (SEB) and other staphylococcal enterotoxins (SEA to SEE) as targets in various challenging matrices. Options for future exercises could include different toxins or even a mixed panel of toxins (e.g., ricin, abrin, botulinum neurotoxins). In late 2024, a training will be provided that will focus on specific challenges for the detection and quantification by suspension immune assay. Future trainings could then include functional assays for different toxins.

5.2 Dry-Lab Exercises (Germany, Denmark, Sweden, supported by the United States)

The US Department of State has been funding dry-lab genome sequence analysis exercises since 2018. This exercise format has evolved over time and building this capacity is seen as critical for the UNSGM. It provides an important capability to investigate biological incidents by enabling analyses of value for attribution purposes. The exercises aim at increasing the level of preparedness of laboratories, enhancing target sequence extraction skills, performing strain characterisation, and promoting a trusted laboratory network with participation from all geographical regions and with demonstrated capability.

Dry-lab exercises conducted between 2021 and 2023 covered genetically engineered poxviruses, highly pathogenic influenza virus, and Mpox virus as target agents. Tasks for participating laboratories included virus identification, genome characterisation, and detection of irregularities, such as mutations and genetic engineering. Not only did the number of participating laboratories increase from 42 in 2021 to 111 in 2023, but equally the performance levels of reaching a minimum of 75% achieved total score rose from 50% in 2021 to 90% in 2023.

In 2024, a fourth exercise was organised using arenavirus sequences (Lassa, Mopeia, Chapare, Junin, Mafiga, Sonega). The tasks again included virus identification and genome characterisation, including detection of irregularities, such as artificial sequences, indicators for the strain being a lab strain, and reassortants.

90 laboratories participated from 40 countries representing all geographical regions. This broad participation showed that sophisticated bioinformatics capabilities are available across the globe and could be mobilised for the UNSGM.

Overall, 84 of the 90 participating laboratories, which corresponds to 93%, reached a performance of 75% or greater. Thus, the proficiency has increased once more compared to the previous exercise, and the number of participating laboratories remained high as well as globally distributed.

5.3 'Future Pandemic Testing' Exercise (China)

After organising a wet-lab 'Disease X Testing' exercise in 2022, China organised a second wet-lab exercise, under the title of 'Future Pandemic Testing'. Samples were dispatched in February 2024 and the analyses were conducted in April and May 2024. The exercise was prepared and conducted by the Harbin Veterinary Research Institute, which harbours the State Key Laboratory of Veterinary Biotechnology as well as national and international (WOAH, FAO) reference laboratories on a range of diseases. It also hosts the National High Containment Laboratory for Animal Disease Control and Prevention with BSL-3 and BSL-4 facilities.

The exercise was based on a zoonotic scenario by simulating human contacts with goats, chicken and prairie dogs as possible pathogen carriers. Suspect pathogens included Rift Valley fever virus and two subtypes of the Influenza A virus. The participating laboratories were tasked with pathogen identification, determination of the amount of viral genes, assessment of pandemic potential, phylogenetic analysis and genetic characterisation of the detected pathogen(s), identification of the animal source, and suggestions for disease control.

Most participating laboratories achieved high scores in the exercise. State of the art technologies were employed and pertinent ideas were put forward by the laboratories about how to manage such an outbreak. The exercise created an important opportunity for the participating laboratories to assess their capabilities and further improve their performance.

6. Sampling Guidance, Associated Documentation and Training (Canada)

In the run up and as preparation for the Capstone Exercise in 2022, Canada had developed a comprehensive suite of guidance documentation for the UNSGM, structured along key areas of a UNSGM Quality Management Structure (QMS): General QMS; Mission planning and support; Command, control, communications; Health, safety, security; Confidentiality and information management; Investigation-related activities; and Sampling.

With regard to sampling, Canada prepared operating procedures and supporting guidance documentation for environmental biological sampling and biomedical sampling, also addressing the issues of sample packaging and transport. The document suite was peer-reviewed by experts from Australia, Canada, France, Germany, Switzerland, the United Kingdom, and the United States. Some of these guidance documents were used in the Capstone Exercise and subsequently transformed by UNODA into Practice Notes for this purpose. They are now being used in trainings and based on feedback from the trainees further adjusted.

An example presented at the workshop was a draft Practice Note on Environmental Sampling. It provides an outline of the tasks related to environmental biological sampling in a UNSGM investigation and reflects the correct methods, materials and procedures required to obtain samples fit to be sent to a designated laboratory for analysis. The Practice Note addresses planning and equipment considerations, types of evidence to be collected, handling and collection procedures, the documentation required, a field guide, and examples of forms to record sample information and chain of custody data. It uses colour coded images for easy visualisation of the requirements as per the UNSGM Guidelines and Procedures (A/44/561).

In close cooperation with Canada und UNODA, INTERPOL is now offering a 'biological crime scene management course' as part of the UNSGM specialised trainings. The course addresses the key steps in a bio-crime scene investigation and combines theoretical as well as practical instructions with a four-day field exercise. With regard to criminal investigation principles, it focuses on clarifying the roles and responsibilities of the personnel involved, evidence prioritisation, and forensic principles.

Course feedback and review by UNODA expert consultants helps to further refine the sample collection and chain of custody forms. A first course was implemented in February 2023, involving 28 qualified experts from 24 countries, whereas a second course in August 2024 involved 20 qualified experts from 18 countries.

In summary, the QMS suite for the UNSGM has been reviewed and updated on several occasions. It is fit for purpose but will continuously be enhanced as more experience is gathered. The procedures and supporting documentation for environmental sampling are also being continuously updated during operational exercises and training. Furthermore, QMS documents and protocols will be updated based on feedback from Member States to ensure continuity and further product development.

7. Table-Top Exercise on Concurrent Investigations and other Projects (United States and Switzerland)

The workshop participants were briefed on recent and ongoing projects to strengthen the UNSGM that have been or are being supported or implemented by the United States. The many activities include:

- Dry lab genome sequence analysis exercises (see above);
- Identification of resources in other international organisations that can support UNSGM investigations and preparedness;
- Interview skills training;
- Pre-deployment training workshop;
- Field analysis test of samples using a MinION device;
- Laboratory twinning between the Centers for Disease Control (CDC) in Atlanta in the United States and Protechnik Laboratories in South Africa, in the field of toxin analysis;
- Table-top exercise on concurrent national and international public health and forensic investigations of a biological incident;
- Investigations in a non-cooperative environment;
- Inspection documentation management;
- Projects to address the Group of Friends of the UNSGM action plan tasks;
- Project on building support for the UNSGM in Latin America;
- Genomic sequence analysis training in South-East Asia.

To support this range of activities, several things need to be in place: a training coordinator should be appointed, a secure data portal should be set up and integrated into the UN's IT system, additional advanced training courses should be delivered, and problem-solving workshops and exercises should be implemented. There is also a need to develop guidelines for addressing misinformation, and more laboratory twinning projects should be initiated. A coordinator for a dedicated US project in support of Latin America is planned to be appointed to manage outreach efforts and support a laboratory twinning project in the field of toxin analysis.

In June 2024, a table-top exercise was conducted by the United States and Switzerland to better understand how concurrent investigations of a biological incident (such as concurrent investigations by the public health service, law enforcement services, and the UNSGM) would proceed and to what degree and how these different processes would interface, compete, or even interfere with each other. This type of exercise is important because in the past, the views and requirements of law enforcement have not sufficiently been taken into account when discussing the process of a UNSGM investigation. The report on this table-top exercise is in preparation. A future exercise to address the particular challenges associated with the conduct of an investigation in a non-cooperative environment is under preparation.

These plans also follow up on the evaluation of the 2022 Capstone Exercise, which highlighted how important it is to enhance preparedness with regard to communications (handling of formal and social media) and to improve interviewing proficiency of witnesses and victims. They also tie up with the formalisation of key documents such as the laboratory reporting template, the template for technical arrangements between designated laboratories and UNODA, and the different practice notes and guiding documents being developed.

Finally, Switzerland announced plans to conduct a Biothreat Reduction Conference co-organised with WOAH, in the autumn of 2025.

8. Conclusions and next steps

This ninth UNSGM Designated Laboratories Workshop confirmed that the UNSGM – the only international mechanism to investigate allegations of biological weapons use – is ready for the task. Substantial progress has been made thanks to the combined efforts of UNODA and Member States, including the development of a network of designated laboratories. Such a trusted laboratory network is vital for the operational readiness and credibility of the UNSGM. The evolving network meets the highest scientific standards, and laboratories continue to improve their understanding of the political and procedural environment they would have to function in, should they be called upon to support a UNSGM investigation.

The participation of laboratories, in the effort to develop the network, has steadily grown. Many more laboratories from more countries are now involved and a continuous stream of laboratory exercises in various formats contribute to increasing laboratory proficiency. At the same time, these laboratory exercises serve to increase the knowledge base about the laboratories available to the UNSGM. Some of the laboratories participating in the exercises are not yet nominated to the UNSGM roster but may, if necessary, form a reserve that could be called upon.

The workshop series has evolved into a planning platform for the development of this UNSGM laboratory network. It also acts as an interface between scientific expertise and policy processes. It helps laboratory representatives to think about their role in this type of investigation, understand the requirements at the different stages of such an investigation, and appreciate the procedural and political pressures that they would be exposed to in such an investigation. EQAE, trainings and exercises also help to better understand the interfaces between the different steps and actors involved in an investigation. This is critical, as interfaces can become points of failure or barriers to mission success.

On the practical side, the different elements of a UNSGM Quality Management System are being developed and refined, including guidance documents, a Laboratory Reporting Template, and Practice Notes are being developed, peer-reviewed and tested in training and exercises. The benefits of having a draft Technical Arrangement available is evident and UNODA will now proceed with formulating such a draft with the intent to make it available to roster laboratories to help them prepare for any contingency. EQAE results help expand the knowledge base about the capabilities and capacity of the laboratories available to the UNSGM, which will facilitate the selection of the appropriate laboratories for a specific UNSGM investigation.

The workshop also helped further develop the interplay between UNODA and partners such as the OPCW, WHO and WOAH, both with regard to building operational capacity and in the actual conduct of an investigation. The experience gathered by the OPCW Investigation and Identification Team (IIT) will be an important asset as the UNSGM continues to explore forensic avenues of relevance for the purpose of attribution, including the laboratory capabilities needed to this end.

One of the gaps that has been identified at previous workshops relates to investigations of biological attacks targeting animals and plants. The One-Health approach may offer opportunities to begin addressing this issue.

Continuity and sustainability are critical to ensure that the UNSGM will continue to be fit for purpose. Equally important remains the further enlargement of the geographical participation in these efforts and the strengthening of partnerships with other international, regional and national partners that can support the UNSGM. The workshop series organised by Spiez Laboratory remains an effective platform to discuss these issues and help all partners coordinate their activities and share the results and progress. The tenth UNSGM Designated Laboratories Workshop to be organised by Spiez Laboratory is scheduled for 9 to 11 September 2025.

Group photo


Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
UNSGM Designated Laboratories Workshop
11 – 13 September 2024, Spiez, Switzerland